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*Project Summary*

# Phytoplankton Water Quality Relationships in U.S. Lakes, Part VIII: Algae Associated With or Responsible for Water Quality Problems

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**Environmental data are presented for 117 species and 24 genera of freshwater algae that have been associated with or responsible for water quality problems. The environmental data are based on algal occurrence records from 250 lakes sampled in Eastern and Southeastern States. These data provide a basis for analyses to further delineate the environmental requirements of problem algae. The water quality problems addressed include eutrophication, organic pollution, taste and odor, filter clogging, toxicity, and aesthetic nuisance. Data presented illustrate that most genera and species associated with eutrophic conditions also occur in nutrient-poor waters, thus limiting their indicator value with respect to nutrient enrichment.**

***This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Las Vegas, Nevada, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).***

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## Introduction

This report identifies those species of algae reported to be responsible for, or associated with, specific water quality problems in lakes, and presents environmental data associated with their occurrence. These data provide a basis for analyses that will further delineate the environmental requirements of problem algae. Environmental data associated with the occurrence of known problem algae can be used to help states meet lake classification requirements under Section 305b and monitor the success of Clean Lakes restoration efforts under Section 314 of the Federal Water Pollution Control Act (PL 92-500), as amended. The study follows the basic premise that identification of environmental conditions surrounding the occurrence of problem algae is implicit in any rational approach to their control or manipulation.

## Procedure and Discussion

In this study, six categories of algae-related water quality problems were addressed: eutrophication, organic pollution, tast and odor, filter clogging, toxicity, and aesthetic nuisance growth. Extensive species lists of algae associated with each problem category were compiled from the literature. To determine the environmental conditions surrounding the absence, presence, and dominant occurrence of problem algae,

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approximately 25,000 phytoplankton records and 750,000 physical and chemical data points were analyzed and compared. These records and data points were compiled from study of 250 lakes in Eastern and Southeastern States sampled during 1973. The study summarizes the environmental conditions for more than half of those 220 species and 34 genera of freshwater algae associated with one or more of the problem categories listed in the accompanying table.

Most of the taxa for which data are not available are normally found attached to substrates (e.g., rocks, sticks, and other algae) or free-living in shallow water, intermingled with other vegetation. As such, their occurrence in the plankton can be expected to be relatively rare.

Although representatives of all major groups of freshwater algae are associated with one or more problems, certain members of the blue-green algae are repeatedly associated with a variety of problem events. *M. aeruginosa* and *G. echinulata* were associated with five of the six problem categories and each of *Aphanizomenon flos-aquae, Coelosphaerium keutzingianum, Microcytis aeruginosa, Gloeotrichia echinulata, Anabaena circinalis,* and *Oscilatoria rubescens* was associated with at least three of the problem categories.

## Conclusions

Environmental data presented are especially pertinent to the problem of eutrophication because of the lake selection criteria used in the study. With few exceptions, algae commonly associated with eutrophic conditions also occur in nutrient-poor waters, thus limiting the value of these algae as indicators of nutrient enrichment. The mere presence of a "eutrophic" form does not necessarily mean that the water body will have associated problems.

The continued review and modification of specific physical and chemical data for each species of problem algae, such as listed in Table 1, will result in modifications of old approaches and the development of new approaches to the biological classification and monitoring of water quality. Conversely, knowledge of algal water quality relationships will increase the ability of workers to predict and prevent or control algal problems.

The information on problem algae environmental relationships, derived by this study, constitutes valuable input for the development and update of water quality criteria required by the U.S. Environmental Protection Agency under Section 304 of PL92-500 and for prediction of biological responses to nutrient and other environmental parameters by area-wide planners responding to Section 208 of the Act.

***Table 1.*** *Problem Algae Identified in 250 Lakes in 17 Eastern and Southeastern States Sampled in 1973, with Problems Indicated*

*Actinastrum* - E, T & O
  *hantzschii* - OP
*Anabanea* - E
  *planctonica* - T & O, AN
*Anabaenopsis* - T & O
*Ankistrodesmus* - E
  *falcatus* - OP
*Aphanizomenon*
  *flos-aquae* - E, T & O, T, AN
*Arthrospira*
  *jenneri* - OP, E
*Asterionella* - E
  *formosa* - FC, AN
  *formosa v. gracillima* - T & O
*Ceratium*
  *hirundinella* - E, T & O, FC
*Chlamydomonas*
  *globosa* - T & O
*Chlorella* - T & O, E
  *vulgaris* - OP
*Chlorogonium*
  *elongatum* - OP
*Closterium* - T & O, E
  *moniliferum* - FC
*Cocconeis*
  *diminuta* - E
  *placentula* - OP
*Coelastrum*
  *microporum* - OP, E
*Coelosphaerium*
  *kuetzingianum* - T & O, T, E, AN
*Coscinodiscus*
  *rothii v. subsalsa* - OP
*Cosmarium*
  *bioculatum* - E
*Crucigenia* - E
*Cryptomonas*
  *erosa* - OP, T & O
  *ovata* - OP
*Cyclotella* - E
  *comta* - T & O
  *meneghiniana* - OP, E, FC
  *stelligera* - E
*Cymatopleura*
  *solea* - OP, E
*Cymbella*
  *prostrata* - E
  *ventricosa* - FC
*Diatoma*
  *vulgare* - OP, E, T & O, FC
*Dictyosphaerium* - E
  *ehrenbergianum* - T & O
  *pulchellum* - OP, FC
*Dinobryon*
  *divergens* - T & O
  *sertularia* - FC
*Eudorina* - T & O
  *elegans* - OP
*Euglena*
  *acus* - OP
  *gracilis* - OP
  *oxyuris* - OP
  *pisciformis* - OP
*Eunotia*
  *pectinalis* - OP, E
*Fragilaria* - E
  *brevistriata* - E
  *capucina* - OP, E
  *construens* - OP, E, T & O
  *crotonensis* - OP, E, FC
  *pinnata* - E
*Gloeocystis* - E
  *planctonica* - T & O
*Gomphonema*
  *angustatum* - E
  *olivaceum* - OP, E
  *parvulum* - OP, E
*Gomphosphaeria* - E
*Gonium* - T & O
  *pectorale* - OP
*Gyrosigma* - E
*Lepocinclis*
  *fusiformis* - E
  *ovum* - OP
*Lyngbya* - E
  *contorta* - T
  *limnetica* - AN
*Mallomonas*
  *caudata* - T & O
*Melosira* - T & O, E
  *ambigua* - E
  *granulata* - OP, E, FC
  *granulata v. angustissima* - OP, E
  *italica* - E
  *varians* - OP, E, FC
*Meridion* - T & O
  *circulare* - E
*Merismopedia*
  *tenuissima* - OP, E
*Micractinium*
  *pusillum* - OP, E
*Microcystis* - E
  *aeruginosa* - OP, E, T & O, T, AN
*Navicula* - E
  *cuspidata* - OP, E
  *lanceolata* - E, FC
  *minima* - E
  *rhynchocephala* - OP, E
  *tripunctata* - E
  *viridula* - OP, E
*Nitzschia* - E
  *acicularis* - OP, E
  *amphibia* - E

***Table 1.*** *(Continued)*

*palea* - OP, E, FC
*sigmoidea* - OP, E
*Oocystis* - E
*Oscillatoria* - E
*amphibia* - FC
*chlorina* - OP
*limosa* - OP
*princeps* - OP, FC
*tenuis* - OP, T & O
*Pandorina*
*morum* - OP, T & O, E
*Pediastrum* - E
*boryanum* - OP
*duplex* - OP
*simplex* - E
*tetras* - T & O
*Peridinium*
*cinctum* - E, T & O
*wisconsinense* - FC
*Phacus*
*pleuronectes* - OP
*pyrum* - OP
*Phormidum* - FC
*Pleurosigma* - T & O
*Rhizosolenia*
*eriensis* - E
*longiseta* - E
*Rhoicosphenia*
*curvata* - OP, E
*Rhopalodia*
*gibba* - OP, E
*Scenedesmus* - E
*abundans* - T & O
*acuminatus* - OP
*dimorphus* - OP
*obliquus* - OP
*quadricauda* - OP
*Skeletonema*
*potamos* - E
*Sphaerocystis*
*schroeteri* - E
*Spirulina* - E
*Staurastrum*
*chaetoceras* - E
*paradoxum* - T & O
*pinque* - E
*Stephanodiscus*
*astraea* - E
*dubius* - E
*hantzschii* - OP, E, FC
*invisitatus* - E
*niagarae* - T & O
*Surirella* - E
*ovata* - OP
*Synedra* - E
*acus* - OP, E, FC
*acus v. radians* - FC
*delicatissima* - E
*pulchella* - E, FC
*radians* - OP, E
*ulna* - OP, E, T & O
*Synura*
*uvella* - OP, T & O
*Tabellaria* - E
*fenestrata* - T & O, FC
*flocculosa* - OP, FC
*Tetraedron* - E
*muticum* - OP
*Trachelomonas*
*crebea* - FC
*volvocina* - OP
*Ulothrix* - T & O, E

E - eutrophication
FC - filter clogging
OP - organic pollution
T - toxicity
T & O - taste and odor
AN - aesthetic nuisance

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*The complete report, entitled "Phytoplankton Water Quality Relationships in U.S. Lakes, Part VIII: Algae Associated With or Responsible for Water Quality Problems," (Order No. PB 81-156 831; Cost: $23.00, subject to change) will be available only from:*

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